IMPROVEMENTS IN CASH COUNTING

This invention concerns improvements in cash counting, especially to the accuracy of cash counting devices that employ weighing techniques in determining cash values.

It is a longstanding problem that the amount of cash held within cash registers is not immediately obvious. It is desirable that the real content of a cash register is frequently reconciled against the content as predicted by what is keyed or scanned into it, for reasons that include the need to identify malpractice by cashiers.

An example of an 'intelligent' cash register is disclosed in European patent application EP 0724242 to Tellermate Plc., which describes a cash register comprising weighing means arranged to take weight readings from the cash compartments of the cash register. The weight readings of each compartment may then be converted to a cash value by a processing unit so that the cash value contained in each compartment of the register drawer or cashbox may be obtained without manual intervention.

It will be appreciated that the term cash used herewith does not merely refer to banknotes and coins but also to any type of accepted tender. For ease of reference all banknotes and items based upon absorbent substrates like paper or card shall be referred to simply as 'banknotes' and the remainder shall be referred to simply as 'coins' in the rest of this specification.

With all cash counting devices employing weighing techniques, accurate operation relies upon knowing an established weight for each denomination of banknote or coin being weighed.

It is desirable to re-establish weights as the condition of the money varies. For example, the weight of damp banknotes differs appreciably from their dry weight. To provide for this, cash counting devices employing weighing techniques are usually able to automatically re-calibrate upon sensing a

~~trigger action, typically the start of a new count. In the case of a closed cash~~ drawer this is typically the completion of a new transaction. For avoidance of doubt, the term "transaction" may refer to any activity that involves the cash drawer being opened or shut, automatically or manually.

Taking banknotes as an example, a typical re-calibration method first evaluates the Total Number of banknotes in a group, found by dividing the total weight of that group by the established weight of that denomination of banknote. If the resultant value is an exact whole number, there is no need to carry out further steps. However, as specific banknotes may differ from their previously established weight, the resultant value will almost certainly contain a fractional part. The fractional part of the resultant value is used in a further index calculation typically according to the following formula

$$\left(\frac{\text{Fractional part}}{\text{Total Number}}\right)\times\theta$$

Wherein θ is a calibration adjustment speed factor, and the result of the above calculation is applied to the previously established weight to form the re-established weight by the formula:

$$\textit{Re-established weight} = \textit{Old Weight} \;+\; \left(\frac{\text{Fractional part}}{\text{Total Number}}\right)\times\theta$$

It is worth noting that the fractional part may lie between -0.5 and +0.5 ~~depending on the rounding and/or integer calculation used.~~

The calibration adjustment speed factor θ represents the amount by which the calibration is adjusted. If the adjustment is too large then erroneous operation (such as the placement of a coin into a banknote compartment by mistake) will affect the next re-calibration before the mistake is spotted and corrected. Conversely, if the re-calibration adjustment is too small, conditions (typically environmental) may have changed, affecting the weight of the banknotes, potentially sufficiently to result in an erroneous calculation of the number of banknotes. The range of appropriate values for θ is determined by

~~experimental analysis, and it is usually set at the lowest possible value~~ consistent with adequate responsiveness.

The moisture contained in banknotes can typically influence their weight by up to 5%. Banknotes put into a cash drawer in a damp state could therefore lose up to 5% of their weight over a period of time. Banknotes put into a cash drawer in a dry state can gain weight over time if the local environment becomes humid. Any weight established for the banknotes when they were put into the drawer may be substantially wrong by the time of the next transaction.

It is with a view to solving this problem that the following is presented: a method of counting a number of cash items of the same type comprising periodic calibration that involves retrieving an earlier established weight for said type of cash items, weighing said number of cash items to determine the current established weight for said number of cash items and storing the current established weight for use as the earlier established weight in a following transaction, wherein said periodic calibration is initiated autonomously.

The invention also resides in apparatus for counting cash items of the same type comprising: weighing means for weighing a number of said cash items; data storage means for storing weight data generated by the weighing means; processing means for retrieving from the data storage means an earlier established weight for said cash items, and sending to the data storage means a re-established weight for said cash items following a re-calibration; wherein said apparatus is arranged to initiate re-calibration autonomously.

Further optional and preferred features are described in the appended dependent claims.

In order that the invention may be more readily understood, some embodiments in accordance therewith will now be described, by way of example, with reference to the accompanying drawings in which Figure 1

~~exemplifies a typical hardware system for implementing the method of~~ the invention, and Figure 2 shows a functional block diagram of the method of the invention.

In Figure 1, there is provided weighing means 2 which may comprise the cash drawer of an intelligent cash register or some type of weighing or force measuring device with an output indicative of the weight measured. Weighing means 2 is connected in turn to a processing unit 4 so that data relating to the weight of a sample placed upon the weighing means 2 may be transferred to the processing unit 4. Also connected to the processing unit 4 is a data store 6 and the processing unit 4 may read and write data to/from the data store 6. A display unit 8, is optionally connected to the processing unit 4. For example, the processing unit 4 may, instead of being a stand-alone unit, be connected as part of a larger network (not shown in Figure 1) and receive and transmit data to a network controller (also not shown).

In use, to determine the value or number of a plurality of cash items placed on the weighing means 2, the weight reading output from the weighing means 2 is fed into the processing unit 4 which determines the cash value by processing the weight reading output using a stored value of the established weight retrieved from the data store 6. If, at any point, a re-calibration is performed thereby generating a new weight as defined previously, this weight can be written to the data store 6. The weight thus recorded becomes the established weight.

Optionally, the weight readings may be retained, together with timestamps relating to the recordal of each item. This data may provide a pattern for weight variation against time from which a look-up table of weights to be expected at given times of the business day may be used to impose adjustments to established weights.

Turning to Figure 2, this shows the method of the invention implemented by the apparatus shown in Figure 1. Starting at 1, an intelligent cash register drawer having associated weighing means 2 (shown in Figure 1) is in an idle

~~state and an idle timer is running under control of the processing unit 4 of~~ Figure 1. Although not shown in Figure 2, the intelligent cash register will have a predetermined value for the weights of each cash type which values are stored in the data store 6 of Figure 1. The values may be determined by experimental means, or they may be derived from previous re-calibrations.

The timer value increments at 3 and a check state is entered at 5 wherein a check is carried out to determine whether a transaction request has been received by the cash register. Should the answer to check state 5 be positive, the cash in each compartment of the cash register drawer is counted at 7 and a re-calibration is carried out at 9. The idle timer is cleared at 11 and the process reverts to 3 whereupon the idle timer increments once again while awaiting a transaction request as before.

Should the check state at 5 produce a negative answer indicating no transaction has occurred, a further check state 13 is entered to check whether a predetermined threshold for the idle timer has been reached. Should check 13 be negative, the process reverts back to 3 and the idle timer continues to increment.

Should the check state at 13 produce a positive answer, indicating that no transaction has been made but that the threshold for the idle timer has been reached (i.e. a timeout), a forced drawer count is undertaken at 15 and an update, similar to step 7, is performed at 17 to establish new weights. The last step at 19 is to clear the idle timer and restart the process from 3 wherein the idle timer increments afresh.

This invention makes use of the realisation that the drawer remains closed and no change in the contents can have been made since the last transaction.

In use, the intelligent cash register exemplified by EP 0724242 would recalculate the cash value of the cash in each compartment of the drawer after each transaction. By means of the present invention, the process described above ensures that the weights for counting are determined by re-

calibration~~, even if the register remains unused. The period chosen between~~ forced re-calibrations can be user defined, or it can be set automatically. Automatic triggering may be in response to external factors such as a detected change in ambient climatic conditions such as temperature or humidity (whether such change is detected to have actually occurred or is expected from past experience to occur).

It is envisaged that the intelligent cash drawer, when used as part of a network of cash drawers connected to a central controller, could initiate a re-calibration upon receipt of a suitable signal sent via the network.

It is further envisaged that the drawer may continuously monitor the weight of the cash present and, by virtue of the fact that the number of items cannot change whilst the drawer is closed, repeatedly re-establishes the weight used for counting each denomination.

It should also be noted that whilst the above process is exemplified in the context of a cash register drawer or box, the method of the invention is equally applicable to all counting devices using weighing techniques, where the number of items to be counted remains unchanged over a period of time.